A METHOD OF GASIFICATION OF WASTE

Field of the Invention

This invention relates to a method of treating waste.

Background to the Invention

In the context of the rise of environmental consciousness and the tightening of environmental legislation, industry is currently using a wide variety of waste treatment methods. These include for example: incineration, anaerobic digestion, land fill, thermophilic composting, by-product rendering, gasification and pyrolysis. The present invention is in essence an improvement to a gasification method of treating waste. The closest prior art known to the applicant comprises a drier using a turbulent flow of heated air and a centrifuge action followed by a gas converter to convert waste into gas suitable for combustion. This prior art method takes untreated general domestic waste and submits the waste directly to this two-step process of drying and gasification.

One of the objectives of the present invention is to present a method which can be suitable for the treatment of not only primarily solid domestic waste but also can be used to treat waste with a high liquid content. It is a further objective of this invention to provide a method which is suitable for liquid/solid mixture waste treatment.

The invention also aims to provide a method which has improved thermal characteristics. The invention further aims at reducing or eliminating altogether undesirable odour emission.

It is also a particular objective of the invention to present a method of treatment of waste suitable for treatment of poultry waste containing feathers.

Summary of the Invention

In a first broad aspect, the invention provides a method of treating waste comprising the steps of drying said waste and submitting said dried waste to gasification for producing a combustible gas, characterised in that the method comprises the step of separating the waste into a portion for shredding and a portion for filtering prior to drying.

This combination of method steps is particularly advantageous because it allows the method to apply to waste which is other than pure solid waste and particularly to waste where there is a portion of solid, associated with a high portion of liquid/solid mixture waste. This method contributes to maximising the amount of waste susceptible of being submitted to drying and gasification. This will also reduce the extent to which waste liquid would have to be treated to meet stringent environmental levels.

In a second broad aspect, the invention provides a method of treating waste, comprising the steps of drying said waste and submitting said waste to gasification for producing a combustible gas, characterised in that the method comprises the step of submitting liquid waste with solids in suspension in the liquid to filtering means to substantially separate primarily solid waste from primarily liquid waste prior to drying said primarily solid waste.

This combination of method steps is unique in that it allows the treatment in this context of liquid waste containing solids in suspension which would hitherto have been simply discarded.

In a third broad aspect, the invention provides a method of treating waste, comprising the steps of drying said waste by supplying heated air to said waste, submitting said dried waste to gasification for producing a combustible gas, burning said gas to generate electricity and exchanging heat from the burning of the gas with the air supply to the waste for drying the waste.

Providing such a heat exchange renders this method more energy efficient and more environmentally friendly. This is particularly beneficial when drying materials which have a high liquid content near 30% because the energy consumption for satisfactorily drying this kind of waste would otherwise be quite substantial.

In a fourth broad aspect, the invention provides a method of treating waste, comprising the steps of collecting and cooling waste, drying said waste and submitting said dried waste to gasification for producing a combustible gas.

Cooling waste marks a radical departure from the prior art teaching of either simply adequately sealing waste or treating gaseous emissions from waste.

In a subsidiary aspect in accordance with any of the preceding aspects, the method when applied to waste containing feathers comprises the step of submitting quills of feathers to a cutter with a plurality of cutter blades so configured to section the quills.

This is particularly advantageous, it reduces the risk of any quills progressing through the system and possibly blocking certain areas. This method therefore is advantageous because it reduces the frequency at which any apparatus implementing this method would have to be serviced as a consequence of quills building up in a particular location.

In a further subsidiary aspect in accordance with any of the preceding broad aspects, the method comprises the step of routing the exhausts from the drying step and the gasification step to a single thermal oxidiser.

This is a particularly efficient method of reducing or eliminating altogether pollution from the drying and gasification steps whilst being particularly efficient in terms of the

manufacturing steps required and apparatus that would be required to carry out this method.

The invention also provides an apparatus adapted to carry out a method in accordance with any of the preceding aspects.

Detailed Description of the Figure

The single figure accompanying this application illustrates one example of the method of the present invention. The method illustrated shows the arrival of dry material in lorries and the arrival of fluid/solid mixture such as a slurry in a pipe line. It is envisaged employing a sealed unloading bay when using vehicles to transport waste. The unloading bay may be isolated from the rest of the plant by sealed doors. Means may be provided to ensure that the building operates under a negative pressure to reduce the possibility of gases escaping. The lorry may tip its load into a sunken pit from where the waste can be screw fed onto either a belt conveyor or any other transport means as selected by the person skilled in the art. The pit may comprise a sealed lid to prevent odour leakage. A drainage system is envisaged to pump any spills during unloading to an effluent treatment plant. Strainers (for example with 4mm drain traps) may be fitted to the drainage system to capture solids for further treatment.

The method envisages that waste would be stored prior or during treatment in order to allow the method to be flexible. The waste may be collected for example in storage tanks where for tanks containing liquid/solid mixtures, cooling coils may be employed to maintain a stable temperature and reduce fugitive losses which are typically present during hot weather. These tanks will be typically enclosed, lidded vessels. These tanks may be emptied by pump or screw auger should the waste stored be suitable for flowing. The tanks envisaged may incorporate vents fitted with carbon filters to prevent odour escaping during filling or breathing. The tanks may also be fitted with level sensors and alarms to prevent over-filling.

Prior to the steps of drying and gasification, the waste may be pre-treated. In this context, the method envisages a step of separating the waste into a portion for shredding and a

portion for filtering prior to drying. A mixture of carcass, gut, bone, head, feet, feathers, sludge, blood may be separated into a solid portion including bones etc and a solid/liquid mixture. This separation may be carried out by a screening process (for example static wedge, inclined screw, rotary drum). The primarily solid waste product from the screening filtering process may be broken down by shredding. For this purpose, macerators are commonly used in the rendering industry for cutting up meat waste.

Waste with high liquid content may be submitted to other filtering means such as belt presses which could remove a large percentage of water. The invention also envisages, as a further filtering means, the use of a centrifuge which could be particularly useful for blood and effluent treatment plant sludge. A centrifuge being fed sludge, blood and mixed material may produce for example a de-watered cake of for example 24% and 39% dry solids. The cake produced by the centrifuge may be used as biomass fuel or used as soil improver or landfill (as shown on the flow chart attached). Preferably, the waste will be pre-treated to be about 30% dry so as to be ready to be fed to a drier.

The drier may be of the kind which has an air heater pumping hot air into a mixture chamber into which waste is fed and mixed to the hot air and flows through the mixer in a turbulent flow. The mixture of heated air and waste may be submitted to a centrifuge to separate the now dried solid waste and the exhaust air.

The dried waste may be stored for further treatment or directly channelled to a gas converter for gasification. The gas converter may be formed of a sealed vessel with a heated outer skin. The heat of the gas converter may be supplied by gas burners arranged at regular intervals around the vessel. The sealed vessel essentially excludes air and may run at a temperature of approximately 800°. Due to the small particle size resulting from the pre-treatment carried out on the waste the particles of waste rapidly convert to a clean, high energy gas with a relatively small portion of ash generated (approximately 7% of input). The vessel may be of the kind which allows ash particles to fall by gravity to the base of the chamber. The resulting ash consisting of residual carbon plus inert materials may be then cooled by a non-contact water jacket and collected in dedicated containers. The ash may be used for road building, construction materials and fertilisers. The gas produced by the gas converter may be ducted to a blast cooler for rapid cooling from 800°

to 22°. The cooler will be selected so as to avoid synthesis and formation of dioxins and furans. The cooled gas may then be bubbled through a scrubber using an aqueous solution of chlorine dioxide as the absorbent. After scrubbing, the gas may be fed to gas engines or gas turbines or any other suitable electricity generating means selected by the person skilled in the art from known alternatives. The skilled person may select a gas engine which is turbo charged and spark ignited. The engine exhaust gases may be ducted back to the drier in order to contribute to the heating of the drier's input air.

Emissions from the gas engine and the gas converter may be channelled to a thermal oxidiser which is adapted to control emissions to the atmosphere. The exhaust from the drier, centrifuge or other gas emissions may all be channelled to the thermal oxidiser which would limit any discharge to the atmosphere.

It is also envisaged to use the gas generated by the gas converter to fuel the gas converter itself and/or the thermal oxidiser. This would reduce the amount of gas necessary to be supplied to the gas converter and would cause the system to be largely self-fuelling. A natural gas may however be supplied to the gas converter and/or thermal oxidiser during a start up phase and means may be provided to switch between the natural gas supply and the gas generated by the converter once a threshold of converted gas is reached.